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PROVISIONAL INTELLIGENCE REPORT

PETROLEUM IN THE SOVIET BLOC

SURVEY OF POSSIBILITIES AND POTENTIALS IN FUTURE PETROLEUM REFINING IN THE USSR

CIA/RR PR-13 (I-D)

ANNEX

22 September 1952

Note

The data and conclusions in this report do not necessarily represent the final position of ORR and should be regarded as provisional only and subject to revision. Additional data or comments which may be available to the user are solicited.

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ANNEX

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SOURCES*

1/ CIA 643970, Foreign Documents Division Translation 311. Classification of USSR Petroleum According to Gost 912-46. 13 August 1951. Confidential.

2/ A series of intelligence reports variously dealing with petroleum geology, oilfield developments, petroleum productions, petroleum qualities, refining installations, production of natural gas and natural gas liquids, oil and gas pipelines, and related subjects in the USSR. Data considered to be useful in some cases and questionable in others. Secret/US Officials Only. Distribution from late 1949 onwards.

25X1

(a) Survey of the Soviet Oil Industry.

(b) Study of the Volga-Ural Oil Regions.

(c) The Azneft Production and Exploration Operations. Caspian Area.

(d) The Emba Oil Region (Kazakhstanneft).

(e) The Oil Regions of Central Asia.

(f) The Grozny Oil Region.

(g) The Turkmenian Oil Region (Turkmenneft).

(h) The Daghestan Oil Region (Dagneft).

(i) The Oil Fields of the Sakhalin Island (Dalneft).

(j) The Natural Gas and Petroleum Substitutes Industry in the USSR.

(k) The Cracking Process in the USSR.

(l) The Exploited Oilfields of the Baku Region.

* cf. Sources appended to the following reports in CIA/RR PR-17, Petroleum in the Soviet Bloc:
I-B, Production and Exploration of Petroleum in the USSR.
I-C, Refining of Petroleum in the USSR.

25X1

(m) [redacted] The Oilfields of Ukraine (Ukrneft).

(n) [redacted] The Oilfields of Georgia (Grozneft).

(o) [redacted] The Oil Industry of the Satellite States.

(p) [redacted] The Ukhta Oil Region. Pechora Region.

(q) [redacted] The Maikop-Kuban Black Sea Oil Region.

25X1 (r) [redacted] The Baku Oil Fields in 1951.

[redacted]

4/ D.M. SHEMKIN, Is Petroleum a Soviet Weakness? Oil and Gas Journal, Vol. 49, No. 33 (21 December 1950).

5/ Badger Design Data for USSR Lend-Lease Refineries with Houdry Catalytic Systems. Process and Operating Data Book, 41 Volumes, National Archives Files. Secret

6/ USBM Bulletin 401. Properties of Typical Crude Oils from Fields of the Eastern Hemisphere 1937.

7/ General Analyses of USSR Baku Oils. "Treasure Island" abstracts of Mat. SSR (USSR Oils), by VELIKOVSKIY and PAVLOVA, published 1945. Abstract Serial Numbers 88536, 88949, 88953, released March-April 1951.

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8/ [redacted] USSR: Petroleum Chemistry. Confidential/US Officials Only. 31 March 1949.

9/ [redacted] USSR: Critical Analysis of Petroleum Production Figures Which Appeared in the Petroleum Press Service, London, February 1949, 26 May 1949. Secret/US Officials Only.

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10/ [redacted] USSR: Revised Estimate of Soviet Petroleum Production (i.e. in 25 August 1949. Secret/US Officials Only.

11/ [redacted] USSR. Survey of the Petroleum Industry. 15 July 1949. Confidential/ US Officials Only.

12/ CIA 532375. Foreign Documents Division Summary 38. Aromatic Hydrocarbons Derived from Petroleum. 1 December 1950. Confidential.

13/ Review and Forecast Numbers, Oil and Gas Journal, 25 January 1951, and 28 January 1952. Review-Forecast Issues, World Oil, 15 February 1951, and 15 February 1952.

14/ US Air Target Research Branch Working Paper #57. Geographical Distribution of Crude Production in the USSR. February 1952. Secret.

15/ Preliminary data released from the intelligence branch files by US Air Target Research Branch. Spring 1952. Secret. Not released as official Air Force Study.

16/ US Air Target Research Branch Working Paper. The Output of Refined Petroleum Products in the USSR. July 1952. Secret. Not an official Air Force Study. Apparently distributed as extract from over-all study in progress.

25X1 17/ [redacted]

25X1 18/ [redacted] September 1951. Secret.

19/ CIA 801405. Army AC of S, G-2: Intelligence Staff Study Project #[redacted]. USSR: Estimate of Vulnerability of Soviet Facilities in the Caucasus. 12 June 1952. Secret.

20/ CIA 291495. Foreign Documents Branch Translation 20/49. USSR Technical Standards for Petroleum Products. 17 March 1949. Confidential.

I-E

SYNTHETIC OIL INDUSTRY IN THE USSR

Summary

Synthetic oils supplement the natural hydrocarbons that comprise petroleum and gas: these together constitute the important commercial sources of gasolines, other fluid hydrocarbon fuels, and a great variety of other hydrocarbon products. In the USSR it is probable that the synthetic oil industry will follow the trend in non-Communist countries and become increasingly important. This has become a global trend in view of the increasingly critical strain exerted by modern demands upon natural petroleum reserves. Increase in synthetic oil availability in the USSR might have one effect in reducing the need of hydroforming for obtaining aromatic avgas additives. Investigations into possible petroleum substitutes are at present emphasized in world economy.

Synthetic oils may be defined for the present purpose as liquid fuels essentially composed of hydrocarbons, derived by means other than the ordinary processing of natural petroleum. In this respect the destructive hydrogenation of a natural petroleum residue is not considered to be ordinary processing. Further, coal is a term here applied generally so as to include not only the true coals such as those of the various anthracite and bituminous grades, but also lignite or brown coal. The latter is the naturally occurring solid carbonaceous substance that is intermediate between peat and the true coals, in the degree of natural carbonization and destructive

distillation prevalent through geologic ages. Lignite is an abundant substance in the USSR.

Synthetic oils of commercial importance are of these three general types: coal carbonization oils, shale oils, and true synthetic oils. The true synthetic oils are those produced by hydrogenation processes, basically developed as modifications of the Fischer-Tropsch Hydrocarbon Synthesis and the Bergius Hydrogenation Process. The latter two processes were catalytic techniques originated in Germany prior to World War II.

The Fischer-Tropsch type of process involves the hydrogenation of carbon monoxide : it produces hydrocarbon stocks that are essentially aliphatic and at least initially olefinic. Prior to conversion by subsequent processing, Fischer-Tropsch products are not sources of aromatic or other carbocyclic components, and they are not general sources of avgas stocks. The Bergius type of process involves the destructive hydrogenation of carbon compounds in a carbonaceous charge, where the charge is either solid or liquid. The source of charge for the latter operation is predominantly coal in the commercial applications, either in a properly constituted coal generally below anthracite in carbon content, or in the tar derived by carbonization (i.e., destructive distillation) of the coal. Application of the Bergius technique to shale oil charge stock is becoming important in world economy, however, and the technique has also been commercially extended to natural petroleum residue charge stock. The Bergius type of process is capable of yielding large quantities of high octane avgas base, equivalent to the catalytic avgas base stocks directly derived from natural petroleum. By variation of operation, the process will also yield large quantities of benzene and more useful aromatic avgas additives.

It is known that the USSR has true synthetic oil process plants although current studies are not yet in a stage to provide more than a preliminary intelligence estimate of the status of these plants. Subsequently to World War II, the Soviets have sequestered and removed to the USSR considerable synthetic oil plant equipment originally installed in the Nazi German areas now within the Communist orbit.

Official US agencies have in recent years sponsored intensive and extensive pilot plant investigations into oil shale technology and both of the basic types of true synthetic oil processes. Table I is included for reference, to indicate what might be reasonably expected from Soviet use of the Bergius type of coal hydrogenation. This table also shows certain US production statistics for comparison. Similarly as in the cases where catalytic systems are used for the cracking of petroleum stocks, the Soviets would attain higher potentials in avgas production by operating the Bergius installations for high octane avgas base rather than for aromatic avgas additives.

Like the Fischer-Tropsch oil products prior to subsequent conversion, unconverted shale oils are generally unimportant with respect to commercial contents of high octane avgas components. Heavy and tar residuals typically constitute large portions of shale oil, however, and commercial charge for catalytic destructive hydrogenation may be constituted by these complex shale oil residuals. A similar status prevails for heavy residuals from natural petroleum. High quality and high octane gasoline hydrocarbons may be thereby derived from the residuals. True cracking conversion techniques are nevertheless more efficient as a rule for this purpose insofar as the techniques are applicable.

TABLE I

Coal Hydrogenation Operation:

US Bureau of Mines Data f/

Product	Total 1949 US Production a/ (Thousands) Bbl/Yr	Tons/Yr	Estimated Yields Coal Hydrogenation (30,000 BPCD Plant) b/ BPCD e/	(Thousands) Bbl/Yr	Tons/Yr
c/ Operation for Aviation gasoline Base					
Propane			5,127	1,871	150.9
Butane			1,974	721	66.1
Aviation Gasoline Base			21,660	7,906	930.1
By-Products			1,239	452	56.5
Total			30,000	10,950	1,203.6
d/ Operation for Aromatics, Motor gasoline					
Benzene	3,729	520.2	2,219	810	113.0
Toluene	1,947	269.2	3,230	1,179	163.0
Xylenes	1,370	189.2	3,282	1,198	165.5
Phenol		101.9			15.6
Cresols		6.1			25.9
Xylenols					34.0

a/ These USBM statistics represent actual US productions as such by coal carbonization and petroleum processing. The values are appreciably higher than current intelligence estimates of the same 1949 yields as shown in the following table.

b/ USBM estimates for a representative coal charge, based upon extensive experimentation in pilot plants of subcommercial size. The 30,000 BPD capacity rating is the total yield of oil products. The USBM reports indicate that these four general types of operation are possible within the flexibility of the plant: (1) for aviation gasoline base stock production; (2) for production of aromatics and motor gasoline; (3) for production of aviation gasoline, motor gasoline, jet fuel, and diesel oil in widely adjustable proportions; and (4) for production of diesel oil and heating oil (kerosene, etc.). The operation flexibility is somewhat dependent upon quality of coal charge. Yields of total oil products typically vary as follows, in Bbl/Ton of coal charge: 2.0/1 from good bituminous coal; 1.5/1 from subbituminous coal; 1.0/1 from lignite.

c/ Type of operation in the hydrogenation plant.

d/ Type of operation in the hydrogenation plant from which only the principal aromatic yields are shown.

e/ Barrels per calendar day.

f/ Data given in tons (metric units) and in barrels (42 US gallons each).

Preliminary intelligence studies are summarized in the present report, showing tentative estimates of the USSR hydrocarbon oil stock production by coal hydrogenation and oil shale processing. Direct coal hydrogenation by the Bergius technique appears to be the only true synthetic oil process presently employed by the Soviets. There is no firm evidence of the existence of Soviet commercial facilities for the Fischer-Tropsch process, or of the application of the Bergius process to take liquid charge (coal tars, shale oils, petroleum residuals). The major Soviet Bergius facilities are reportedly at present under construction and expansion and in various states of completion. Future expansion of Soviet oil shale processing is also indicated. For hydrocarbon oils produced annually by the more definitely identified Bergius plants in the USSR, the tentative intelligence estimates include a value of 650,000 metric tons in 1951, one of 1,325,000 metric tons in fiscal 1953, and a potential of 2,750,000 metric tons upon completion of the plants. Similar estimates of shale oil productions include 700,000 metric tons in 1951 and 1,000,000 metric tons in fiscal 1953. These estimates are believed to be too incomplete to warrant a general correlation with the estimated Soviet natural petroleum product potentials. The estimated Bergius yields are, however, correlated in the estimates of Soviet avgas potentials.

In the general hydrocarbon liquid fuels in a national economy, coal carbonization stocks are closely related to those obtained from natural petroleum and by the Bergius synthetic oil process. Light hydrocarbon oils (mostly aromatics) and coal tar are by-products in coal carbonization to produce coke, and the Bergius process is effective with coal tar as a feed, permitting considerable simplification in comparison to the

application of the process for direct hydrogenation of coal. Other than in natural petroleum processing, gasoline aromatics are produced in quantity only in the coal carbonization and Bergius hydrogenation industries. Benzene from coal carbonization is a significant potential blend stock for motor gasolines, and it is otherwise important as a potential charge stock for catalytic alkylation, thereby yielding even more valuable high octane aromatics in the gasoline boiling range.

The existing byproduct coal carbonization industry is not indicated to be extensively developed in the USSR. These byproducts are actually subject to intelligence analysis from two distinct economic standpoints: first, for the yield of substances conventionally classified as chemicals, and second, for the yield of hydrocarbon oils to supplement the liquid fuels and other oils obtained by natural petroleum processing and other means. While no intelligence study is made from the latter standpoint at the present time, a preliminary intelligence analysis is available for coal carbonization chemicals in the USSR 1/.* Table 2 shows estimates given in the available study. The table includes comparative US productions at values somewhat smaller than the previously summarized USBM statistics for the same yields.

* Footnote references in arabic numerals are to sources listed in the Annex, Appendix B.